VITAL AND SOCIAL STATISTICS.

The Mortality Statistics of the Eleventh Census.

The vital statistics reports of the census have grown in unwieldy bulk and increased in tardiness more or less regularly with each successive census, until the reports for 1890 exceed in size those of any previous census, and the most important volume for the use of the majority of the state registration and sanitary services in this country[1] was not distributed until 1898, or nearly eight years after the end of the year for which the statistics were collected. As a result, much of the interest and value of these statistics have been lost. The accuracy and usefulness of these volumes are not in proportion to their size and to the length of time occupied in their preparation and publication.

Fundamental imperfections of the census statistics of mortality.—Ever since the first attempt to present mortality statistics in the seventh census (1850), the necessary unreliability of data collected by the method of enumeration, as contrasted with the proper method of immediate registration, has been thoroughly understood by the authorities in charge of the census. Nevertheless, the same blunder has been committed decade after decade in the framing of the census law, until to-day, after half a century has shown the impossibility of securing reliable statistics by this method, a census bill is before the House of Representatives for action, after passage by the Senate, which contains the same defective provisions. It may be questioned, in this matter of legislation for obtaining mortality statistics by the census,

[1]Eleventh Census. Vital and Social Statistics. Part I.

whether a blunder, after sufficiently long repetition, ever becomes a crime. Perhaps, if the mortality statistics of the census were presented sufficiently early to be of greater interest to sanitarians and to the public, and in a manner in which their bald imperfections would be more conspicuous, instead of being more or less concealed by the mass of secondary details, there would arise a more urgent public demand for better methods in this branch of the work.

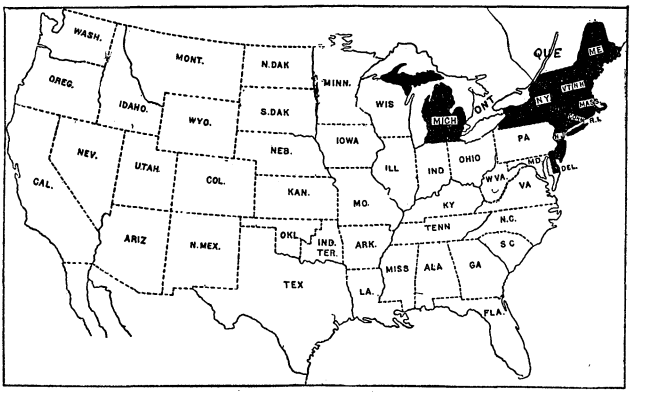
The only mortality statistics of reliable character presented by the census are those with whose *collection* the census had nothing to do. Even in the rates presented for the registration states, comprising only about one-third of the population of the country and about one-twenty-fifth of its area, there is no certainty that the same degree of accuracy of registration exists.[1] Some very misleading comparisons may be the result of imperfections of registration in some of the registration states and cities. The census ought to be able to verify the accuracy of its data in all cases, and for the non-registration states this is absolutely essential, if we are to know anything at all in a definite way in regard to their mortality.

I may be excused from proving the primary assumption that the first duty of a registration service, or of a census which deals with mortality statistics, is to supply reliable death rates. This is the first and fundamental requisite of a satisfactory sanitary service, and no elaboration of other ratios will excuse its absence. No one knows except by conjecture what the death rate of the United States is, nor can the relative prevalence of the important infectious diseases be satisfactorily determined from the census data.

[1][For evidence that this accuracy varies see below, 128, table.—W. F. W.]

Registration and non-registration areas.—The distinction between the registration and non-registration areas is so important, as affecting the validity of the census statistics of mortality, that it may be useful to insert a map showing the probable registration area

MAP SHOWING REGISTRATION AND NON-REGISTRATION STATES, 1898.



States having registration of deaths based on certificates of death and burial permits are black.

for the coming census. Since 1890, only two states have been added to this area, Maine in 1891, and Michigan in 1897, so that the prospect of improvement of the general mortality statistics of the census by the gradual extension of state registration, unless something is done to further such extension, would seem to be slight. The population represented by registration records in 1890 was 21,093,320, and that for which the statistics were obtained by enumeration was 41,528,930.[1] The statistics presented for the registration area are second-hand, that is to say, the census has simply made a somewhat more elaborate compilation of data which are already accessible to a large extent in the state and municipal reports. It is in the non-registration area that the col-

[1]Eleventh Census. Compendium, 2; 3. But compare *Idem*, Vital Statistics, 1: 11.

lection of reliable mortality statistics is chiefly needed, and there the census ought to be able to perform the most valuable service, inasmuch as the public health officials of the non-registration states have now no reliable means of measuring the efficiency of sanitary work.

There has been retrogression in the accuracy of the statistics of the non-registration states in 1890, as compared with the preceding census. This is frankly admitted by the compilers of the census:

"This death rate [13.98 for the entire country] is lower than that given in the census of 1880, viz., 15.09, and higher than that given in the census of 1870, viz., 12.77. This does not indicate any actual change in the death rate, but rather that the enumerators' returns of the eleventh census are more deficient as regards the deaths than was the case in 1880." [1]

"The actual death rate for the non-registration area in 1880, as based upon the enumerators' returns, was 13.42 per 1,000 of population, while the same class of returns now give a rate of but 10.79 per 1,000; hence there must either have been a great increase in the healthfulness of the country or the enumerators' returns must be more incomplete as regards deaths than they were in 1880." [2]

So that the main purpose of these statistics of mortality, the determination of the variations of sanitary condition in the country, is not accomplished. It may be pertinent to inquire why, even if we can expect no improvement, the results obtained by the census of 1890 should not have been at least as good as in 1880.

Systematic neglect of non-registration states.—This falling off in the accuracy of the returns from the non-registration localities may be due, at least in part, to a tendency of the census authorities to give less attention to statistics known to be imperfect. There has even been, it would seem, a slight leaning toward a policy of coercion. In a paper by Mr. William A. King, chief of the division of vital statistics of the eleventh census, on the "Vital Statistics of the Census," it is stated:

[1] Eleventh Census. Compendium, 2:3.
[2] *Idem*, 4.

"A number of additional states, including Illinois, Indiana, Iowa, Michigan, Minnesota, Kansas and others, and numerous cities, have laws requiring the registration of deaths, and the data required concerning each death, run all the way from the full details furnished in Massachusetts and New York to the simple statement that John Smith, aged 57, died of 'heart failure.'

"It will thus be seen that if the clause, 'the data for which shall be obtained from the registration records of those states and municipalities possessing such records,' is construed as mandatory, and the question settled by the mere fact of the existence of a registration law, however inadequate, the value of the aggregate results would be little better than if the enumerators' returns were included. On the other hand, the exclusion of such records would, doubtless, soon lead to such amendment of existing laws and practical administration of the same as to warrant their subsequent adoption."[1]

The fallacy of this conclusion cannot be better shown than by the fact that of the many states left without adequate mortality statistics by the last and preceding censuses, only two, Maine and Michigan, have instituted systems of accurate registration during the last decade, and in their cases the neglect of the government was probably an insignificant factor in leading to the change. While the general government will certainly not be able to increase the number of registration states to any extent by overlooking their interests in the census, it is in its power, as I fully believe, by encouraging and fostering their efforts in the direction of reliable registration, and by giving them a suitable example, to increase very rapidly the registration area. Such work implies continuous effort and foresight in the central registration office.

It would have been well, indeed, if the census authorities had made a somewhat more careful study of the results obtained by the state registration systems. This would have avoided the serious mistake of including Alabama among the registration states, an error which appeared as late as the second volume of the Compen-

[1] Am. Stat. Assn. *Publications.* 5:214,f (1897).

drum published in 1894, but which was rectified in the final report.[1] The most casual examination of the Alabama law and of the annual reports based thereon would have shown that the mortality statistics of that state were among the most defective of any published by the non-registration states. The considerable number of returns made by state authority in such states as Michigan, Minnesota, Ohio and others, returns which were not far below those of the census in completeness, might have been utilized, and by properly supplementing them the results in those states might have been greatly improved. Finally, by consulting the state records, even when of an imperfect character, valuable information could have been obtained as to whether the data for the census year were fairly typical on not. This fault indeed, is common to all the deductions of the census, for registration as well as for non-registration states. A peculiarity in the epidemic prevalence of diseases in the particular year selected for the census would vitiate entirely all of the general conclusions regarding the changes in mortality. Exception must be made of the six large cities, whose data were studied for a six-year period ending at the time of the census; conclusions bases on these studies are much more reliable.

The elastic scale of proportional deaths.—Passing from the fundamental imperfections relating to the collection of the mortality data of the census, we may note in the presentation of the data collected a very serious fault and one which quite unfits the statistics of mortality for general reference by the practical sanitarian. I allude to the use, in the statement of mortality for the non-registration states, of proportional deaths, or deaths

[1] Compare the lists of registration states in Compendium, 2 : 3 (1894) and Vital Statistics, 1 : 10 (1896).

from a given cause per 1,000 deaths from known causes, to the entire exclusion of legitimate death rates.

These proportional deaths are the basis of most of the showy cartograms presented in the mortality reports of the tenth and eleventh censuses, and were, in fact, begun under the ninth census. They have never before been carried out quite so elaborately, however, as in the last census, and may be said to form quite a characteristic feature of these reports. Certainly, they are the feature to which the student of hygiene or health officer would first direct his attention in the examination of the census reports, and from which he would suppose himself able to draw valuable information as to the relative prevalence of diseases. They are, however, entirely unreliable, and even in many cases misleading.

The impropriety of making comparisons of mortality by means of a shifting or elastic scale ought to be evident without special discussion. The false conclusions which may be drawn may be readily seen by comparing two states, one of high and one of low general mortality.

Any given cause of death, *e. g.*, consumption, may be twice as fatal in proportion to population in the one state as in the other, yet if a sufficient excess of deaths from other causes occur in the state having an excessive mortality, the apparent ratio (proportional deaths) may be the same or even less in the state which really has the higher death rate. This source of error pervades the entire use of these ratios. As the size of the ratio is dependent upon two factors, directly, upon the number of deaths from any given disease and, inversely, upon the number of deaths from all diseases, it is evident that the relations of these factors must be thoroughly investigated before any dependence can be placed upon them. This is as much as to say that, for all ordinary practical

purposes, they are worthless, for the preliminary investigation of their validity is a difficult and tedious matter.

Other things being equal, these proportional rates may show the same variations as the actual death rates. Their unreliability comes from the uncertainty attending this proviso. If other things are not equal, a very considerable error may attend the use of these comparisons. The imperfections attending the employment of this method are, indeed, alluded to in the census, as follows:

"For the rest of the country [the non-registration states] the only rates which are of any value are those which can be obtained from the record of deaths alone, without reference to its completeness or to population, being such as the number of deaths due to a given cause per 1,000 deaths from all causes, or at a given age per 1,000 deaths at all ages, or combinations of these two ratios, with distinctions of color, sex, etc. Such rates, as is well known to statisticians, have little positive scientific value as compared with the ratios of deaths to population; nevertheless, they furnish some valuable information and suggestions, and are, therefore, given in this report to a considerable extent."[1]

It may be added that they also furnish much misinformation, and the suggestions to be derived from them are nearly as likely to be wrong as right. Why perpetuate, then, this pseudo-scientific system of alleged mortality rates, which have little in common with genuine death rates based upon population, but which are often mistaken for them in the attempted use of these census statistics by sanitarians? Death rates, although not accurate, would permit of the same relative comparisons, providing the accuracy of enumeration in different states was approximately the same. This ought to be true, and if not so, then the census ought to be able to determine what states or groups of states were fairly comparable. Morever, if the approximate amount of

[1] Eleventh Census. Vital statistics, 1:1.

correction were known, as could be readily determined by the collection of representative statistics from selected areas of each state, the comparability of the data would be greatly enhanced.

Misleading inferences from proportional "death rates."—As a concrete example of the misleading conclusions which are liable to be drawn from the employment of these seductive ratios, I may quote from the report of the Chicago department of health for July, 1897. Under the title, "Chicago as a Health Resort," a paper by Prof. John A. Robison, on the very important subject of the sanitarium treatment of consumption in home climates, is referred to as follows:

"With reference to pulmonary consumption, this is especially true of Chicago and the strip of territory lying along the western shore of Lake Michigan; and when this fact [greater healthfulness] substantiated by a sketch map and certain statistics from the eleventh national census, was pointed out to Dr. Robison, he at once recognized its importance as bearing upon his project. The substance of his paper is as follows: 'Several weeks ago, Dr. F. W. Reilly, assistant commissioner of health, handed me the subjoined map and called my attention to the fact that, contrary to popular belief, the death rate [proportional deaths] from pulmonary consumption was less, adjacent to the west shore of Lake Michigan than further inland. According to the census of 1890, the death rate [proportional deaths] along the lake shore was 84 per 1,000 [deaths], while twenty miles and more inland it was 124 per 1,000 [deaths]. . . . What may be the explanation of this difference? One would naturally expect that the conditions for the increase of tuberculosis—such as overcrowding of the population, poor hygenic surroundings, poverty, poor food and filth—would cause a greater death rate in Chicago. Is the difference due to the greater prevalence of other contagious and infectious diseases, so that the relative lowness of the figures would be due to this factor, or are there climatic differences which make a residence contiguous to the lake more healthful? There may be a mathematical puzzle here, but we are inclined to think that the climate of the great lakes has been ignorantly maligned in the past.'"[1]

[1] Chicago Department of Health. Bureau and Division Reports, July, 1897, p. 4. Dr. Robison's paper was printed in *North American Practitioner*, July 1897.

Of course, the explanation suggested above, but not adopted, is probably the correct one. The high death rates in the lake cities from diarrheal diseases, etc., cause the proportional mortality from consumption to be unduly depressed. While the proportional deaths from consumption in the lake counties of Illinois (including Chicago) were only 89 per 1,000 deaths, as compared with 116 and 132 in the river and central counties respectively, the true death rates from consumption per 100,000 population in the lake, river and central counties were 212.4, 129.6, and 136.2, respectively—a very different showing. In the latter comparison the death rate for the lake counties is exclusive of the city of Chicago, thus eliminating the influence of more accurate registration in this group.

In attempting to make some use of the mortality statistics of the census for comparisons of my own state with other adjacent ones, the liability to such misleading conclusions was at once apparent, and the fact was recognized that the census statistics were practically worthless for such important sanitary purposes unless some means could be found of checking their aberrations. For this purpose a set of true death rates was calculated for the several state groups of Michigan, Indiana, Illinois, Ohio and Wisconsin, and their relations to the proportional deaths given by the census was found. A serious difficulty in the computation of these death rates, but one which would not have occurred if they had been properly presented by the census, is the elimination of registration cities from the non-registration states. No attempt has been made to take out any except the largest ones. The close relations between the variations of the two sets of figures thus obtained seem to negative the assumption of the census authorities that death

rates for non-registration states are worthless, because they are not complete. The relative indications of the death rates, in many cases correspond closely to those of proportional deaths, as "other things being equal," they should, and when discrepancies appear, I believe that the undue variation, in most cases, will be found on the side of the proportional deaths. Certainly, there is no reason why an enumeration conducted in exactly the same way over adjacent states, or even over the entire non-registration area, should not yield reasonably comparable results.

Ratios upon which no dependence can be placed until verified by elaborate calculations ought to have no place in an official report intended for general reference. However, not only have the misleading maps been retained, but a second series, based on the same erroneous principle, has been added, showing the proportional deaths for "grand groups" as well as "state groups." These will not embarrass the practiced statistician to any extent, for he will examine them with the full knowledge that for any exact conclusions they are not reliable, and will readily understand the apparent inconsistencies of the color distribution dependent upon the use of two different scales of color and two different units of area. The state of mind of a health officer or sanitary student, without special training in the devious ways of these peculiar statistics, may be imagined when he consults, *e. g.*, Map 19[1] and perceives from the shading that consumption is apparently more prevalent in the central counties of Michigan than in the lake counties (including the entire Upper Peninsula), while Map 20[2] represents the mortality of the

[1] Eleventh Census. Vital Statistics, 1 : Map 19, facing p. 324.

[2] *Idem.*, Map 20, p. 330.

entire state from consumption as approximately the same. Or scarlet fever may appear in one cartogram to be markedly more prevalent in the central counties,[1] and in the next cartogram[2] just the reverse. The explanation of these apparent discrepancies is, of course, very simple, but the fact that it has to be made unfits them for a report intended for general use. Vital statistics ought to be unambiguous in their indications.

Conclusions and recommendations.—These criticisms have confessedly covered a very small part of the census volumes, and have made no reference either to the subject of occupations of decedents, which has occupied a considerable part of the space given to vital statistics in the census, or to some other matters of importance. This is partly due to the fact that the work has been only very recently published, and, also to the fact, as shown above, that so much labor must be put into the reports in order to draw reliable conclusions that their use is practically prohibited. I believe, however, that the two most important respects in which improvement is desirable have been considered. These are: (1) Improvement in the collection of data; (2) Substitution of death rates, with some criterion of their approximate accuracy, for all proportional deaths in non-registration as well as registration states.

What is most needed to make the vital statistics of the census of sanitary use may be summarized as follows:

1. A permanent organization. Spasmodic efforts every ten years, wholly discontinued in the intervals, cannot achieve the best results. Continuous work is more

[1] *Idem.*, Map 2, facing p. 234.

[2] *Idem.*, Map 3, p. 236.

necessary for reliable vital statistics than for any other department of census work.

2. A closer relation between the census and state and municipal registration. The national bureau should exert a directive influence and promote the establishment of state registration offices on proper lines. Its influence in this respect in the past has been almost *nil.*

3. Prompt presentation of the data collected.

4. Exact knowledge of the accuracy of registration, by special investigation of selected representative districts in registration and non-registration states alike.

5. Study of the intercensal rates of registration states, cities, and also of those non-registration states having uniform records, in order that the epidemic or typical character of the census year may be known.

6. Use of death rates based upon population for all comparative purposes, with the entire discarding of unreliable methods of statement, such as proportional deaths. By the use of two or more colors upon a map, each having the usual gradations of shading, the different degrees of accuracy of registration could be defined, so that there would be no liability of comparing a rate in a non-registration state with one in a registration state. But reliable comparisons could undoubtedly be made in this manner of broad areas of the country.

7. Confinement of the reports to the most essential features of direct sanitary use, avoiding detailed studies of secondary character until, by the extension of the registration area, more reliable statistics are available.

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